College of Engineering
Department of
Mechanical & Industrial Engineering

The Robert W. Courter Seminar Series

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1206 Patrick F. Taylor Hall

Computational development of liposomes with tailored mechanical properties

by Dr. Francisco R. Hung

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Liposomes have gained prominence in drug delivery due to their enhanced therapeutic outcomes, biocompatibility, and ability to bolster drug stability, amplify solubility, and facilitate controlled release. In cancer research, however, the challenge of enhancing drug delivery efficacy to tumor sites remains a central topic. While the effects of properties such as liposome size, shape and surface charge on drug delivery applications have been widely studied, mechanical properties such as liposome elasticity and rigidity remain significantly underexplored. Results from our experimental collaborators indicate that elastic liposomes had increased uptake by human breast cancer cells in vitro, and had significantly larger tumor accumulation in vivo compared to stiffer liposomes. These results suggest that liposome elasticity can be optimally tuned to enhance drug delivery in cancer treatment. An overview of our recent and ongoing combined simulation-experimental studies will be presented in this talk. Our studies aimed at fundamentally understanding how the mechanical properties of the liposomes are affected by variables such as the molecular structure of the lipids, the composition of the liposome, and the presence of embedded hydrophobic drugs.

Francisco Hung is an Associate Professor in the Department of Chemical Engineering at Northeastern University since Fall 2016. Prior to his current appointment, he was the Paul M. Horton Associate Professor and Director of Graduate Studies in the Cain Department of Chemical Engineering, and an Adjunct in the Center for Computation and Technology at Louisiana State University. He has an undergraduate degree in Chemical Engineering from Universidad Simón Bolívar in Caracas, Venezuela, and a PhD in Chemical Engineering from North Carolina State University. He then worked as a postdoctoral researcher in the Department of Chemical and Biological Engineering at the University of Wisconsin-Madison, and joined the faculty at LSU in Fall 2007. Honors include the CAREER Award from the National Science Foundation in 2013, the LSU Rainmaker Emerging Scholar in STEM Award in 2014, and the Richard Sioui Award for Excellence in Teaching in Chemical Engineering at Northeastern University in 2018. His research program is focused on investigating different systems involving mixtures and interfaces using molecular simulation. Current research interests in his group include liposomes, ionic liquids and deep eutectic solvents, nanoporous materials, crystal nucleation and organic contaminants in environmental interfaces. His research is relevant to applications in drug delivery, separations, energy storage and environmental chemistry.